MULTIMETER

MODEL 260-AFP-1

SIMPSON ELECTRIC COMPANY
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Chicago, Illinois 60644
Area Code 312, Telephone 379-1121

In Canada, Bach-Simpson, Ltd., London, Ontario

Figure 1. Simpson 260-AFP-1, Multimeter, Open.

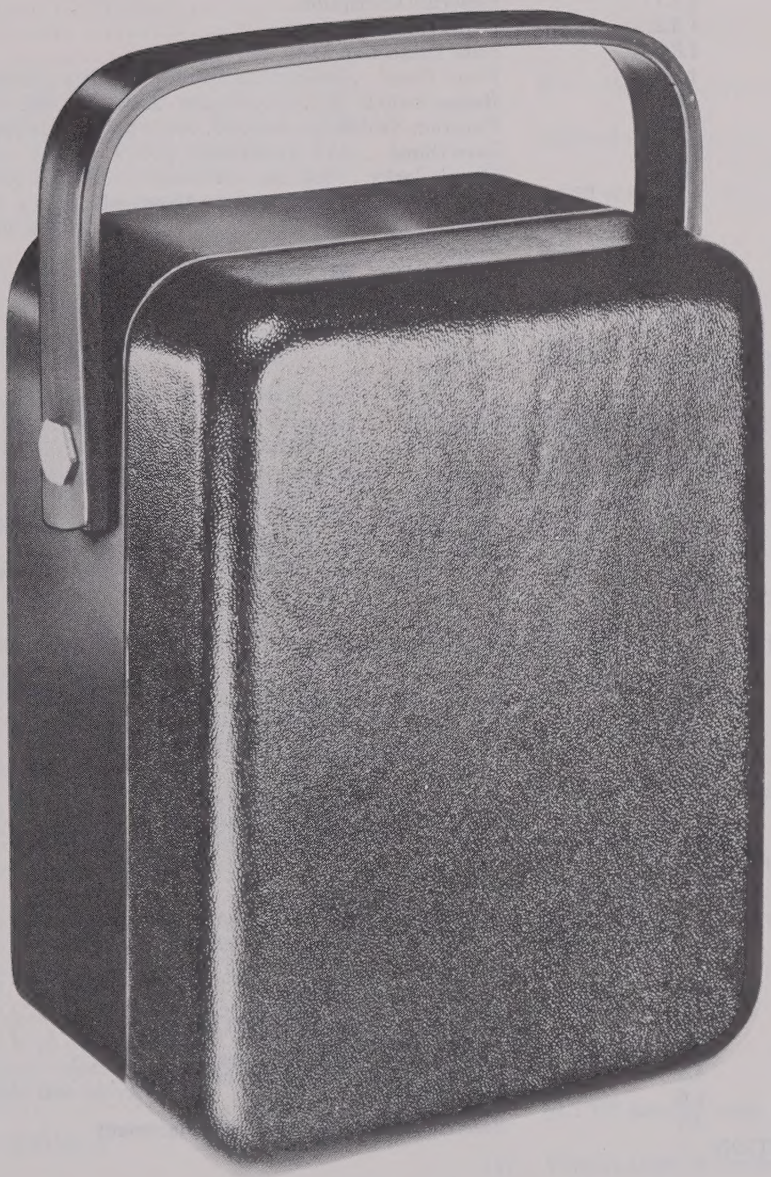

Figure 2. Simpson 260-AFP-1, Multimeter, Closed.

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SECTION I

INTRODUCTION

1. GENERAL.

1.1 GENERAL.

This Manual contains operating and maintenance instructions for the Multimeter, FSN 6625-985-3951, manufactured by the Simpson Electric Company, Government Division, 5200 W. Kinzie Street, Chicago, Illinois, 60644. (See figure 1-1). The Multimeter, identified by the manufacturer as Model 260-AFP-1, contains one set of test leads and batteries.

1.2 PURPOSE OF EQUIPMENT.

The Multimeter can be used to check and test almost the entire field of electrical measurements.

1.3 DESCRIPTION OF EQUIPMENT.

The Simpson 260 ® Series AFP is an accurate, compact, and easy to operate Volt-Ohm-Milliammeter. It is extremely rugged and incorporates a unique overload protection circuit to prevent meter or tester damage in the event of accidental overload. Its primary use is the measurement of electrical characteristics of circuits and circuit components. Accurate quantity measurements of D.C. and A.C. voltages, direct currents, resistances, decibels, and output voltages can be made.

One of the features of the 260-AFP-1 is the use of a high torque annular meter movement. The movement is self-shielded, eliminating errors caused by normally encountered currents and magnetic materials, and is also constructed with spring backed jewels to increase its resistance to possible shock and vibration damage.

A special calibration circuit is used to increase the initial accuracy of the tester and to facilitate recalibration in the event that this should ever be necessary.

The 260-AFP-1 uses the most modern components and circuit techniques. Assembly is done by well trained personnel using quality material and modern equipment. This combination of design, materials, and skillful assembly results in a unit that will take considerable abuse and still provide accurate indication. If it is kept clean and is not subjected to extreme shock or continuous vibration, the 260-AFP-1 will give many years of trouble free service.

1.3.1 GENERAL DESCRIPTION.

a. Accuracy is ± 2% for all dc scales except 0-5000 scale which is ± 3% full scale.

b. Accuracy is ± 3% for all ac scales except 0-5000 scale which is ± 4% full scale.

c. Measurement Ranges.

(1) DC Voltage

0-0.25 volts

0-2.5 volts

0-10 volts

0-50 volts

0-250 volts

0-1000 volts

0-5000 volts

(20,000 ohms per volt sensitivity)

(2) AC Voltage

0-2.5 voots

0-10 volts

0-50 volts

0-250 volts

0-1000 volts

0-5000 volts

(5,000 ohms per volt sensitivity)

(3) AF Output Voltage

0-2.5 volts

0-10 volts

0-50 volts

0-250 volts

(0.1 UF internal series condenser)

(4) Volume Level in Decibels

- 20 to 10 decibels

- 8 to 22 decibels

6 to 36 decibels

20 to 50 decibels

(5) DC Resistance

0-2000 ohms (12 ohm center)

0-200,000 ohms (1200 ohm center)

0-20 megohms (120,000 ohms center)

(6) Current in DC Circuits

0-50 microamperes

0-1 milliamperes

0-10 milliamperes

0-100 milliamperes

0-500 milliamperes

1.3.2 OVERLOAD PROTECTION.

With the exception of the 10 ampere D.C., 1000 volt and 5000 volt A.C. and D.C. ranges, all ranges are protected against inadvertent overload damage by a unique protection system. The sensing circuit is completely electronic and does not depend on unreliable mechanical means for actuation. Instead, a highly sensitive semiconductor senses the voltage drop across the meter circuit and actuates a relay when the voltage reaches a predetermined level. Power for the relay is supplied by the same battery that is used for the Rx10,000 resistance range. Sensing of the voltage drop across the meter is done by means of a bridge network, so that overload protection is provided regardless of the polarity. The protection relay operates at a uniform percentage of overload since the meter circuit is common to all ranges.

Since the same battery is used for the high ohms range and the protection circuit, the tester is designed so that the protection circuit will function normally as long as the high ohms range can be set to zero. However, it is recommended that the complete overload test as described on page 7 be performed to insure proper overload battery operation. To supplement protection of the meter a diode network is connected across the movement to by-pass any transient overloads.

1.3.3 FUSE PROTECTION.

As protection against possible damage to the 10 Amp DC Range, a 10 Ampere fuse is connected in series with circuit under test. If fuse blows, the 10 Amp DC Range will be inoperative. To replace fuse refer to "Fuse Replacement" in Maintenance section.

1.3.4 FRONT PANEL.

The instrument has a large easy-to-read 4—" meter at the top of the front panel. Below the meter are three operating controls, eight circuit jacks, and the reset button. All switch positions, circuit jacks, and reset button are identified with engraved white lettering on a black background to insure long lasting, easy readability.

1.3.5 RANGE SWITCH.

The range switch, in the center of the lower part of the front panel, has 12 positions. It may be turned in either direction to obtain any desired range and circuit position. There are six voltage ranges for D.C. and six for A.C., six ranges for direct current, and three resistance ranges.

1.3.6 FUNCTION SWITCH.

The function switch is located at the left hand side of the lower part of the front panel. It has three positions: —D.C., +D.C., and A.C. When direct current, D.C. voltage, or resistance is to be measured, the function switch may be set at —D.C. or +D.C., depending on the polarity of current or voltage. Reversing the test lead connections without removing them from the circuit under test is accomplished by use of the function switch.

1.3.7 ZERO OHMS.

The control at the lower right on the panel is marked OHMS. This variable resistance in the ohmmeter circuit will be used to compensate for the aging of the internal batteries. Use it to adjust the meter indication to zero (at the right end

of the scale) with the test leads shorted together whenever the ohmmeter circuit is used.

1.3.8 CIRCUIT JACKS.

There are eight jacks, two being located in each corner of the front panel. These are the connection points for the test leads. Plug the prods of the test leads into the proper jacks to obtain the circuit and range desired for each application.

At the lower left are COMMON — and + jacks. These are the jacks that will be used most. Connect the black test lead to COMMON — for all circuits and ranges except 10 amperes D.C. Connect the red test lead to the + jack for all circuits and ranges except those designated by the other circuit jacks.

Across the top of the panel are jacks marked — 10 A., OUTPUT, 50 μ AMPS, and + 10 A. For all audio frequency output voltage ranges, use the red test lead connected to the OUTPUT jack. For the 50 microampere or 250 millivolt D.C. range, use the red test lead connected to the 50 μ AMPS jack. For the 10 ampere D.C. range, use the black test lead in the — 10 A. jack and the red test lead in the + 10 A. jack.

1.3.9 RESETTING THE TESTER AFTER AN OVERLOAD.

The reset button is made of a non-conducting material to insure protection against accidental shock and is located just to the right of the "output" jacks on the front panel. When an overload of sufficient magnitude to trigger the protection circuit is applied to the tester, the reset button will pop up and extend approximately 3/16" above the surface of the front panel.

To reset the tester for normal operation first remove the overload, then press the reset button all the way down and release it. The tester is now ready for normal operation.

If the overload has inadvertently been left connected to the tester, following the reset procedure as outlined above or holding down the reset button will not reconnect the tester circuitry. This "fool proof" feature makes it almost impossible to damage the 260-AFP-1 under usual overload conditions.

1.3.10 PHENOLIC CASE.

The Simpson 260, Series AFP-1 is housed in a black phenolic case. It is molded with heavy reinforced walls for maximum durability. All the component parts are attached or mounted to the front panel: the entire instrument slips into and out of the case in one piece.

1.3.11 PRINTED CIRCUIT.

Conforming to the latest engineering developments, almost all the component parts are mounted on a printed circuit. This simplifies assembly, reduces maintenance, and extends the useful life of the instrument.

1.3.12 ADJUST-A-VUE HANDLE.

The comfortable handle is attached on each side of the instrument case. The handle may be used to support the instrument in a convenient sloping position for easy viewing on the bench top. Of course, the 260 can also be placed in either a vertical or horizontal position.

1.3.13 TEST LEADS.

Each 260, is furnished with one pair of four-foot test leads. One lead is black and the other red for easy polarity identification. The wire is very finely stranded and extra-flexible. Its insulation is a special high-grade rubber which has far more insulation strength than the largest voltages to which your instrument will ever be subjected.

1.3.14 TEST LEAD INSPECTION.

Periodic inspection of the test leads is recommended to detect cuts, burns or other damage that could reduce the insulation strength of the leads. When replacement is indicated, ask your local distributor for catalog number 0115.

SECTION II

PREPARATION FOR USE

2. GENERAL.

2.1 GENERAL.

The 260-AFP-1 Multimeter is a completely self-contained unit utilizing only the external test leads, and a protection cover that fits over the front of the Multimeter when not in use.

2.2 UNPACKING.

No special unpacking is required. The 1.5 volt and 15 volt batteries are packed in the same carton, in a separate bag. (See Section IV, for instructions on how to open case and insulation of batteries. Also Figure 4-2 for proper locations.)

2.3 ASSEMBLY.

Before operation of the 260-AFP-1 see Section IV, for instructions on how to open case and insulation of batteries. Also Figure 4-2 for proper locations.

SECTION III

OPERATING INSTRUCTIONS

3. OPERATING INSTRUCTIONS.

3.1 PREPARATION FOR USE.

a. With volt-ohm-milliammeter (also called a multimeter) in operating position, check that pointer indicates zero at the left side of the scale. If pointer is off zero, adjust the screw located in the case below center of meter scale. Use a small screwdriver to turn this screw slowly clockwise or counterclockwise until pointer is exactly over zero mark at left side of scale.

b. Check battery used in multimeter overload protection circuit for proper voltage as follows:

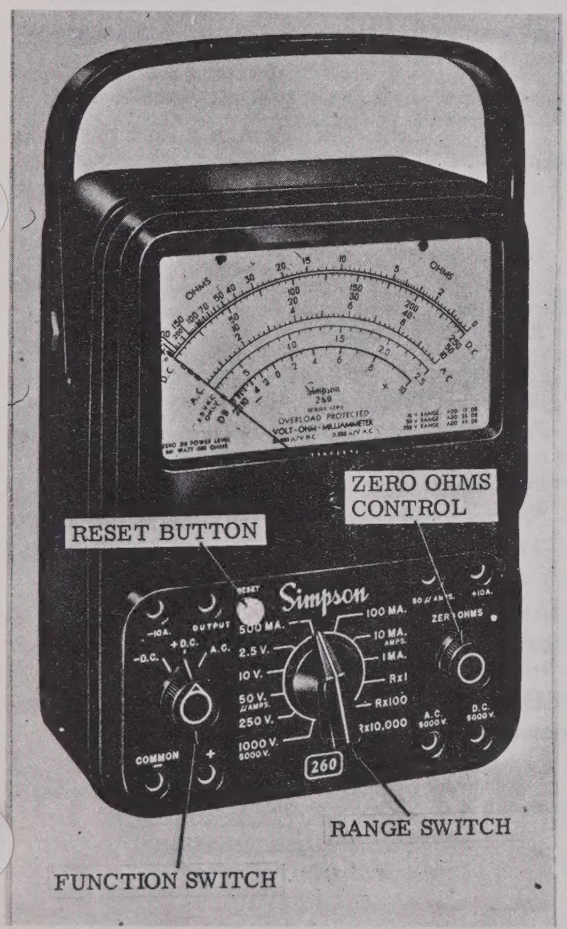

Figure 3-1. Volt-Ohm-Milliammeter Operating Controls

INSTRUCTIONS FOR TESTING CONDITION OF OVERLOAD BATTERY IN 260-AFP-1

(See Figure 3-1)

1. Set range switch (See Figure 3-1) at the Rx 10,000 position.
2. Set function switch to the —DC position.
3. With black test lead plugged into the common (negative) input jack touch other end of black lead to the 50 ua input jack.
4. Reset button should pop out indicating that the internal battery is good.
5. No damage will occur as a result of this test.

NOTE

The overload protection circuit will not function properly if B2 battery voltage is below the minimum level needed to zero the Rx10,000 range.

(6) Disconnect test leads.

c. When an overload of sufficient magnitude to trigger the protection circuit is applied to the multimeter, the RESET button will pop up and extend approximately 3/16 inch above front panel surface. To reset multimeter for normal operation, remove the overload, then press RESET button all the way down and release it. The multimeter is then ready for normal operation.

WARNING

For personal protection, when making voltage or current measurements, turn off all power to the circuit under test. Connect the test leads at the desired points in the circuit; then apply power while taking readings. Remove power from the test circuit before disconnecting the test leads.

3.2 VOLTAGE MEASUREMENTS.

3.2.1 *Measuring D.C. Voltages to 250 Millivolts.*

a. Set Function Switch at +D.C. position.

b. Plug the black test lead in the COMMON —jack and the red test lead in the 50μAMPS . jack.

c. Set Range Switch at the 50μAMPS . position (common position with 50V.).

d. Connect black test lead to negative side of circuit to be measured, and red test lead to the positive side of the circuit.

e. Read the voltage on the black arc marked D.C.; use the figures marked 0 — 250 to read directly in millivolts.

f. Disconnect test leads.

3.2.2 *Measuring D.C. Voltages to 1000 Volts.*

a. Set Function Switch at +D.C. position.

b. Plug black test lead in the COMMON — jack and the red test lead in the +jack.

c. Set Range Switch at one of the five voltage range positions marked 2.5V., 50V., 250V., or 1000V.; choose the voltage range position which contains anticipated voltage to be measured.

CAUTION

When in doubt as to the voltage present, use the 1000V. position as a protection to the multimeter.

d. Connect black test lead to negative side of the circuit to be measured and red test lead to positive side of the circuit.

e. Apply power to the circuit to be tested. If the multimeter pointer deflects to the left of zero, polarity is reversed. To correct the polarity as applied to the multimeter, remove power from test circuit and set Function Switch at —D.C. position. Then apply power to test circuit.

f. Read the voltage on the black arc marked D.C. as follows:

(1) For the 2.5V. range, use the 0 — 250 figures and divide by 100.

(2) For the 10V., and 250V. ranges, read the figures directly on the scale.

(3) For the 1000V. range, use the 0 — 10 figures and multiply by 100.

NOTE

If the voltage is within a lower range, set Range Switch at the lower range position to obtain a more accurate reading.

g. Disconnect power from test circuit; disconnect test leads.

3.2.3 *Measuring D.C. Voltages to 5000 Volts.*

WARNING

Be extremely careful when working in high voltage circuits. Do not touch the multimeter or test leads while power is applied to the circuit being measured.

a. Set Function Switch at +D.C. position.

b. Set Range Switch at 5000V. position (common position with 1000V.).

c. Plug black test lead in the COMMON —jack and the red test lead in the D.C. 5000V. jack.

d. Be sure power is off in the circuit to be measured and all its capacitors have been discharged. Connect black test lead to negative side of the circuit to be measured and the red test lead to positive side of circuit.

e. Apply power to the circuit to be tested. Do not touch the test leads or multimeter. If the multimeter pointer deflects to the left of zero, polarity is reversed. Remove power from test circuit and set Function Switch at —D.C. position to correct the polarity as applied to the multimeter. Then apply power to test circuit.

f. Read the voltage on the black arc marked D.C.; use the 0 — 50 figures and multiply by 100.

g. Disconnect power from test circuit; disconnect test leads.

3.2.4 *Measuring A.C. Voltages to 1000 Volts.*

a. Set Function Switch at A.C. position.

b. Set Range Switch at one of the five voltage range positions marked 2.5V., 10V., 50V., 250V., or 1000V.; choose the voltage range position which contains anticipated voltage to be measured.

CAUTION

When in doubt as to the voltage present, use the 1000V. position as a protection to the multimeter.

c. Plug black test lead in the COMMON —jack and the red test lead in the +jack.

d. Be sure power is off in the test circuit and connect the test leads across the voltage source.

e. Apply power to test circuit and read the voltage as follows:

NOTE

This multimeter measures A.C. voltage in terms of the RMS value of a sine wave.

(1) For the 0 — 2.5V. range, read the voltage directly on the red arc marked 2.5 V.A.C. ONLY.

(2) For the 10V., 50V., and 250V. ranges, use the red arc marked A.C. and read the voltage directly using the black figures immediately above the arc.

(3) For the 1000V. range read the red arc marked A.C.; use the black 0 — 10 figures and multiply by 100.

NOTE

If the voltage is within a lower range, set Range Switch at the lower range position to obtain a more accurate reading.

f. Disconnect power from test circuit; disconnect test leads.

3.2.5 *Measuring A.C. Voltages to 5000 Volts.*

WARNING

Be extremely careful when working in high voltage circuits. Do not touch the multimeter or test leads while power is applied to the circuit being measured.

a. Set Function Switch at A.C. position.

b. Set Range Switch at 5000V. position (common position with 1000V.).

c. Plug black test lead in the COMMON — jack and the red test lead in the A.C. 5000V. jack.

d. Be sure power is off in the circuit to be measured and all its capacitors have been discharged. Connect the test leads into the circuit.

e. Apply power to the circuit to be measured. Do not touch the test leads or the multimeter.

f. Read the voltage on the red arc marked A.C.; use the 0 — 50 figures and multiply by 100.

g. Remove power from test circuit; disconnect the test leads.

3.2.6 *Measuring Output Voltages.*

NOTE

When there is a mixture of A.C. and D.C. voltages, as occurs in amplifier circuits, output voltage is the A.C. component only.

a. Set Function Switch at A.C. position.

b. Plug black test lead in the COMMON — jack and the red test lead in the OUTPUT jack.

c. Set Range Switch at one of the voltage range positions marked 2.5V., 10V., 50V., or 250V.

d. Connect black test lead to the grounded side of circuit to be measured and the red test lead to the "hot" side.

e. Read the output voltage as follows:

(1) For the 0 — 2.5 V. range, read the value directly on the red arc marked 2.5 V. A.C. ONLY.

(2) For the 10V., 50V., and 250V. ranges, use the red arc marked A.C. and read the voltage directly using the black figures immediately above the arc.

f. Disconnect test leads.

3.3 DECIBEL MEASUREMENT.

a. To measure voltages, such as output voltages or audio frequency voltages, in terms of decibels, proceed as follows:

b. Set Function Switch at A.C. position. Set Range Switch at one of the voltage range positions marked 2.5V., 10V., 50V., or 250V., as required.

c. Plug black test lead in the COMMON — jack and the red test lead in the + jack.

d. Be sure power is off in the circuit to be measured and connect the test leads across the test circuit.

e. Apply power to test circuit and read the DB arc at the bottom of the dial. The decibel scale is numbered from —20 to 0 to +10. If you are using a 0 DB power level of 0.001 watt in 600 ohms, and if the voltage which you read was measured across 600 ohms, the DB readings obtained will be correct on an absolute scale as follows:

(1) For the 0 — 2.5V. range, read the DB value directly.

(2) For the 10V. range, read the DB arc and add 12 DB to the reading.

(3) For the 50V. range, read the DB arc and add +26 DB to the reading.

(4) For the 250V. range, read the DB arc and add +40 DB to the reading.

NOTE

If the reference level is 0 DB = 0.006 watt in 500 ohms, subtract (+) 7 DB from the reading to obtain the absolute value of decibels.

f. Disconnect power from test circuit and disconnect the test leads.

3.4 RESISTANCE MEASUREMENT.

a. Set Range Switch in one of the resistance range positions as follows:

(1) Use R x 1 for resistance readings from 0 to 200 ohms.

(2) Use R x 100 for resistance readings from 200 to 20,000 ohms.

(3) Use R x 10,000 for resistance readings above 20,000 ohms.

b. Set Function Switch at either —D.C. or +D.C. position.

c. Plug black test lead in the COMMON — jack and the red test lead in the + jack.

d. When resistances are measured, multimeter batteries B1 and B2 furnish power for the circuit. Since batteries are subject to variations in voltage and resistance over long periods of time, the meter must be adjusted for zero ohms prior to measuring a resistance, as follows:

(1) Connect clip ends of test leads together to short out the resistance circuit.

(2) Observe the meter indication; pointer should indicate 0 on the right hand end of the OHMS arc at top of dial.

(3) If meter indication is not 0, rotate the ZERO OHMS control (figure 3-1) until pointer indicates 0. If pointer will not indicate 0, battery B1 or B2 must be replaced. Replace 1.5-volt battery B1 if Range Switch is set at either R x 1 or R x 100 position. Replace 15-volt battery B2 if Range Switch is in R x 10,000 position.

(4) When pointer indicates zero, disconnect the clip ends of test leads. The ohmmeter circuit is now ready to use.

NOTE

Check and adjust for zero ohms each time Range Switch is positioned to a different range.

e. Connect test leads across the resistance to be measured.

f. If there is a "forward" and "backward" resistance such as in rectifiers, the resistance should be quite small in one direction (for forward polarity) and very large in the opposite direction. Vary Function Switch between the two D.C. positions to reverse the polarity to determine that there is a large difference between the resistances in the two directions.

NOTE

The resistance of such rectifiers will measure different values on different resistance ranges of the multimeter. For example, a crystal diode which measures 80 ohms on the R x 1 range may measure 300 ohms on the R x 100 range. The difference in values is a result of the diode characteristic and does not indicate any fault in the multimeter.

g. Observe the reading on the OHMS arc; note that this arc reads from right to left for increasing values. Multiply the reading by the multiplier factor at the Range Switch position to obtain the resistance value in ohms. K on the dial equals one thousand.

h. Disconnect test leads from test circuit.

3.5 DIRECT CURRENT MEASUREMENTS.

CAUTION

Never connect the test leads directly across any voltage when the multimeter is used as an ammeter. Always connect the meter in series with the load across the voltage source.

3.5.1 *Measuring Direct Currents to 50 Microamperes.*

a. Set Function Switch at +D.C. position.

b. Plug the black test lead in the COMMON — jack and red test lead in the 50 μAMPS. jack.

c. Set Range Switch at 50 μAMPS. position (common position with 50V.).

d. Open the circuit in which the current is to be measured. Connect the meter in series with the circuit; connect red test lead at the positive side and black test lead at the negative side.

e. Apply power in the circuit to be measured. Observe the meter. If the pointer is deflected to the left, the current polarity is reversed. To correct the polarity, remove power in test circuit and reverse the test lead connections. Then apply power to test circuit.

f. Read the current on the black D.C. arc. Use the 0 — 50 figures to read directly in microamperes.

g. Switch off the circuit power. Disconnect the test leads and restore test circuit continuity.

3.5.2 *Measuring Direct Currents to 500 Milliamperes.*

a. Set Function Switch at +D.C. position.

b. Plug black test lead in the COMMON — jack and the red test lead in the +jack.

c. Set Range Switch at one of the four range positions marked 1 MA., 10 MA., 100 MA., or 500 MA., as required.

d. Open the circuit in which the current is to be measured. Connect the meter in series with the circuit; connect red test lead at the positive side and black test lead at the negative side.

e. Apply power in the circuit to be measured. Observe the meter. If the pointer is deflected to the left, the current polarity is reversed. To correct the polarity, remove power in test circuit and set Function Switch at the — D.C. position. Then apply power to test circuit.

f. Read the current, in milliamperes, on the black arc marked D.C. as follows:

(1) For the 1 MA range, use the 0 — 10 figures and divide by 10.

(2) For the 10 MA. range, use the 0 — 10 figures directly.

(3) For the 100 MA. range, use the 0 — 10 figures and multiply by 10.

(4) For the 500 MA, range, use the 0 — 50 figures and multiply by 10.

g. Switch off the circuit power. Disconnect the test leads and restore test circuit continuity.

3.5.3 *Measuring Direct Currents to 10 Amperes.*

a. Plug black test lead in the —10A. jack and the red test lead in the +10A. jack.

b. Set Range Switch at 10 AMPS. position (common position with 10 MA.).

c. Open the circuit in which the current is to be measured. Connect the meter in series with the circuit; connect red test lead at the positive side and black test lead at the negative side.

d. Apply power in the circuit to be measured. Observe the meter. If the pointer is deflected to the left, the current polarity is reversed. To correct the polarity, remove power in test circuit and reverse the test lead connections. Then apply power to test circuit.

NOTE

The Function Switch has no effect on polarity for the 10 AMPS. range.

e. Read the current on the black D.C. arc. Use the 0 — 10 figures to read directly in amperes.

f. Switch off the circuit power. Disconnect the test leads and restore test circuit continuity.

3.6 SIMPLE CAPACITOR CHECKS.

CAUTION

Discharge capacitor completely before connecting multimeter.

a. Set Range Switch at R x 10,000 position.

b. Set Function Switch at either —D.C. or +D.C. position.

c. Plug black test lead in the COMMON —jack and the red test lead in the +jack.

d. Connect test leads across the capacitor; multimeter pointer will indicate infinity on the OHMS scale at the left hand side of the dial. The ohmmeter circuit of the multimeter is used to identify good, open and short conditions for capacitors as follows:

(1) A good capacitor will allow current to flow while it is charging up to the applied voltage. This produces a swing of the pointer to the right, with a gradual return to infinity at the left hand side of the dial. The greater the capacity, the further the pointer will swing and a longer period of time will be required for the pointer to return to infinity.

(2) If the capacitor is open, the pointer will not deflect to the right at the beginning of this test; the pointer will remain at infinity. Very small capacitors will cause the pointer to deflect only a very slight amount, with a rapid return to infinity. Therefore, the pointer must be watched very closely when testing a small capacitor to identify a good or open condition.

(3) If the capacitor is shorted, the pointer will deflect to the right, but will not return, even slowly, to infinity.

NOTE

It is recommended that the results of these simple tests be reconfirmed with more conclusive test equipment.

e. Disconnect test leads from test circuit.

SECTION IV

MAINTENANCE INSTRUCTIONS

4. GENERAL.

4.1 GENERAL.

To gain access to inside of case for adjustment and replacement of parts, use a ¼-inch screwdriver to remove four screws through the back of the case. See figure 4-1 for volt-ohm-milliammeter schematic diagram.

b. To remove the printed circuit board subassembly, proceed as follows:

(1) Set Function Switch at +D.C. position and Range Switch at the 2.5V. position.

(2) Remove the knob for the ZERO OHMS control.

(3) Remove two screws and two hex nuts securing printed circuit board subassembly to meter; lift the printed circuit board subassembly away from the meter.

(4) After removal, do not turn knobs on front of meter, or move rotors on switches, until printed circuit board subassembly is secured to the meter.

4.2 BATTERY REPLACEMENT.

a. When batteries reach the end of their useful life, they must be replaced promptly. Failure to do so may result in extensive damage to the volt-ohm-milliammeter.

b. Observe polarity when inserting a new battery; polarity is marked on the meter adjacent to battery spring contact clips.

NOTE

If battery does not make good contact with the spring contact clips erratic readings on RX1 and RX10 ranges may occur. To ensure reliable connection, the following may be implemented:

(1) Remove back case from meter.

(2) Apply a strip of adhesive RTV (NSN 8040-00-843-0802) approximately 1" long x 3/8" wide x 3/8" high to the inside of the back case immediately behind the D cell battery compartment of the meter assembly.

(3) Allow the RTV to cure approximately 24 hours and replace back cover.

4.3 RECTIFIER REPLACEMENT AND CALIBRATION.

a. Diodes CR1 and CR2, located on printed circuit board near 1.5-volt battery, rectify the A.C. voltages for measurement. If either rectifier is defective, multimeter will give incorrect indications. Be sure to observe polarity when connecting a new diode into the circuit.

b. After replacement of either CR1 or CR2, or both rectifiers, calibrate the circuit in one of the following ways. The procedure outlined in this step requires a 2.5-volt A.C. and a 250-volt A.C. power supply.

(1) Set Function Switch at A.C. position. Set Range Switch at 250V. position.

(2) Plug black test lead in the COMMON – jack and red test lead in the + jack.

(3) Apply 250 volts A.C. across clip ends of test leads; pointer should indicate full scale. Adjust variable resistor R31, located at corner of printed circuit board over fuse F1, until pointer indicates full scale. Disconnect power. (Refer to figure 4-3.)

(4) Set Range Switch at 2.5V. position. Apply 2.5 volts A.C. across clip ends of test leads; pointer should indicate full scale. Adjust variable resistor R28, located next to transistor Q1, until pointer indicates full scale. Disconnect power. (Refer to figure 4-3.)

c. If no standard voltage supply is available for the calibration procedure, use this alternate method:

(1) Set Function Switch at A.C. position. Set Range Switch at 2.5V. position.

(2) Plug black test lead in the COMMON – jack and red test lead in the + jack.

(3) Connect test leads to a fresh 1.5-volt flashlight cell. Connect red test lead to the positive post of the battery and black test lead to the negative post.

(4) Rotate variable resistor R28, located next to transistor Q1, full clockwise.

(5) Adjust variable resistor R31, located at corner of printed circuit board over fuse F1, until pointer indicates 1.8 volts on the 2.5 V. A.C. ONLY arc.

(6) Adjust variable resistor R28 until pointer moves to 1.71 volts on the 2.5 V. A.C. ONLY arc (an indication of 6 on the OHMS arc corresponds to 1.71 on the 2.5 V. A.C. ONLY arc).

d. FOR DC CALIBRATION.

(1) Set function switch at DC position, set range switch at 50 microamps, using shop standards, apply 50 microamps and adjust R-32 for 50 microamps on instrument. (Refer to figure 4-3.)
(2) Set range switch at 1 milliamp, using shop standards, apply 1 milliamp and adjust R-27 for 1 milliamp on instrument. (Refer to figure 4-3).

NOTE

To balance the 50 microamps and the 1 milliamp range, adjust R-27 and R-32.

(3) Using 10 amp jacks, apply 10 amps, using shop standards, and adjust shunt R-22 for 10 amps on instrument.

4.4 RESISTOR REPLACEMENT.

Almost all of the resistors for the Simpson 250, Series AFP-1 are mounted on the rear of the printed circuit. This makes them easily accessible for trouble-shooting and repair.

When it is necessary to replace any of the resistors in the circuit, first obtain an exact equivalent resistor. Then clip the defective resistor off the printed circuit board, leaving the leads in the board to use as connections for the replacement.

Carefully twist the leads for the new resistor around the leads left from the defective resistor, and solder each connection. Trim away all excess and see that you have not caused any short circuit to any other part nearby.

4.5 REMOVING THE PRINTED CIRCUIT BOARD.

When you require access to the under-side of the printed circuit board, or to the parts which are located between it and the front panel, remove the printed circuit board in the following manner.

1. Set the function switch at +D.C. and the range switch at 2.5V.

2. Remove the knob for the ZERO OHMS control.

3. Remove the two screws through the lower part of the printed circuit board.

4. Remove the two hex nuts from the meter studs on the top of the printed circuit board.

5. Lift the printed circuit board away from the front panel. The entire board, with the switch wafers in place, will come up in one piece.

6. After removal, do not turn knobs on front panel or move any rotors on switches until reassembled.

4.6 FUSE REPLACEMENT.

Remove the front panel from the case, and remove the burned-out fuse from its holder. Replace with a 10 amp, 250 volt fuse, Buss type ABC or equivalent only.

4.7 ELECTRONIC OVERLOAD SWITCH REPLACEMENT OR ADJUSTMENT.

To replace the silicone switch Q1 (5-110186) of the 260-AFP-1 carefully unsolder Q1 from the printed circuit board, clean out the holes, and replace with the electronic switch assembly 10-861636. Match the leads, as lettered to the properly marked holes and position the new switch in place as shown in dotted lines on the cutaway view, see figure 4-0. After securing and soldering in place, turn the function switch to D. C. + and range switch to 2.5 V. Connect the test leads from the "common" and + jacks to a D. C. power supply accurately calibrated to deliver at least 15 volts (suggested source is Simpson Model 2600.) Connect the test leads to the power supply and instantaneously apply 15 VDC from power supply to the 260-AFP-1. The reset button must "POP OUT" and the meter should indicate zero. If the reset button fails to "POP OUT" adjust potentiometer on the electronic switch until it "POPS OUT" at 15 VDC. NOTE: Use only a non-conducting screwdriver for adjustment.

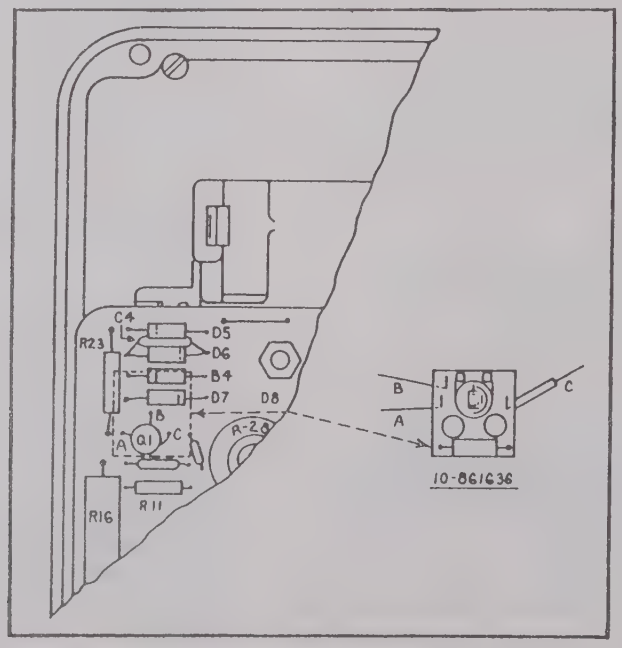

Figure 4-0. Schematic Diagram

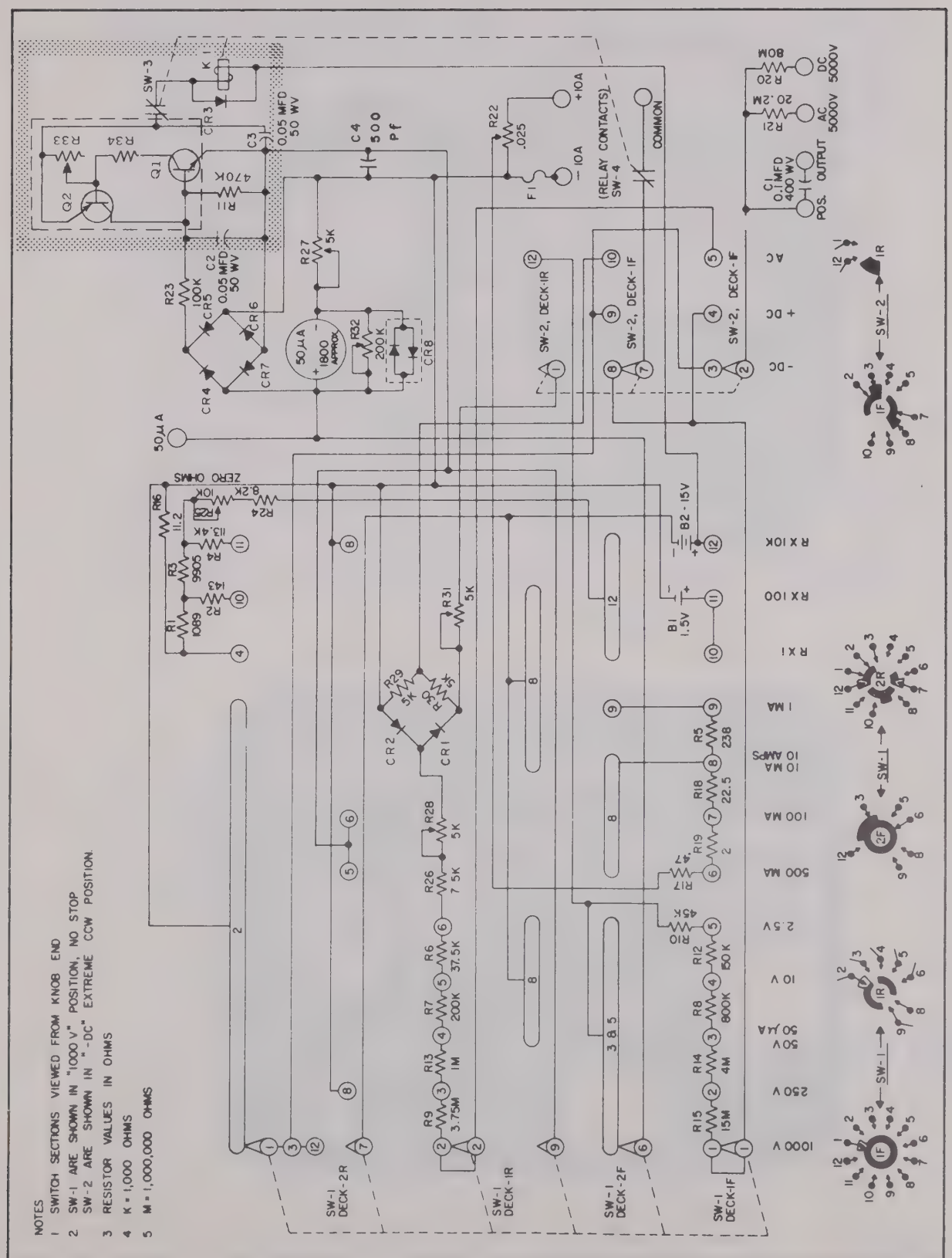

Figure 4-1. Schematic Diagram for Model 260, Series AFP-1, Volt-Ohm-Milliammeter

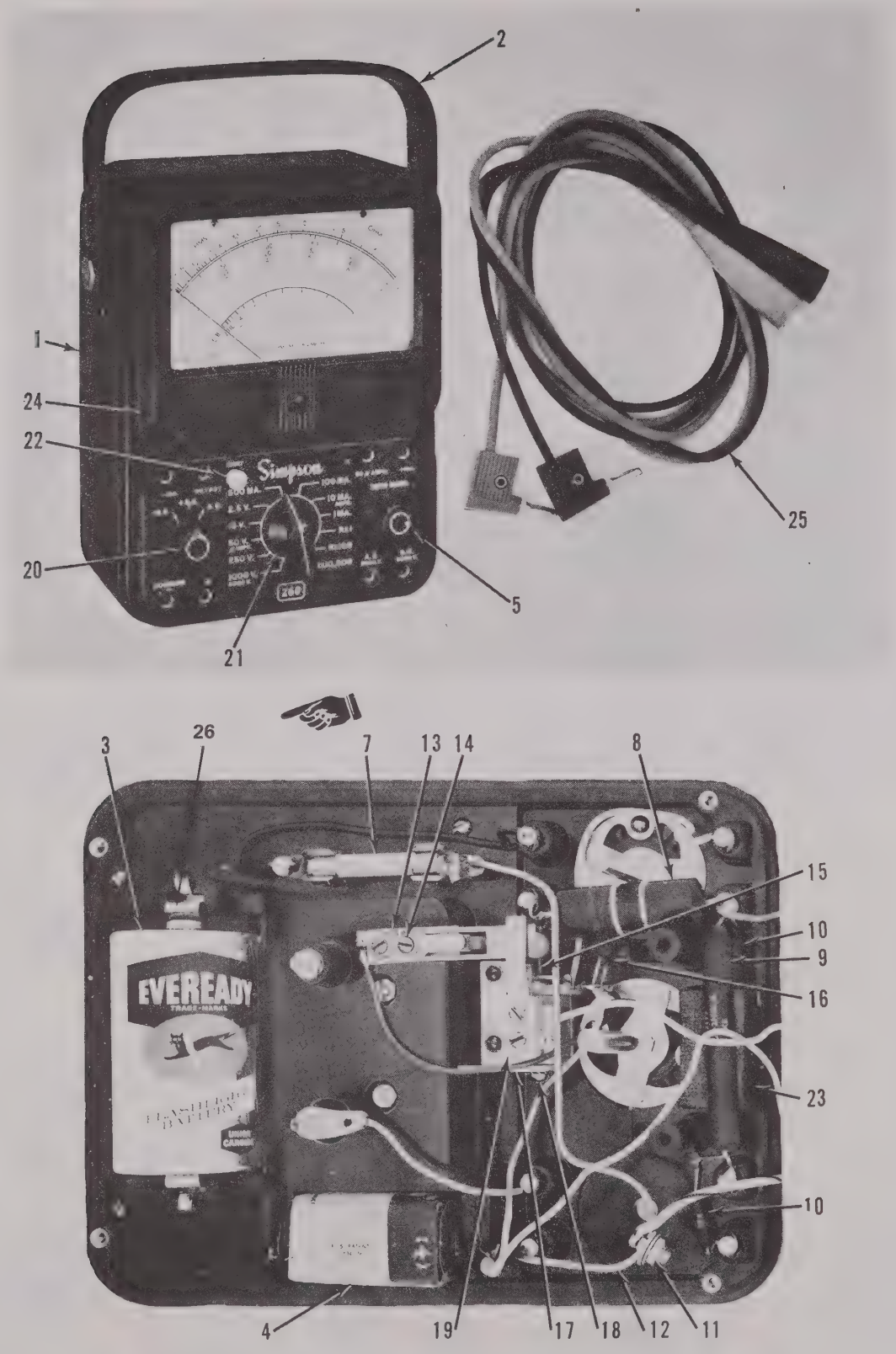

Figure 4-2. Model 260, Series AFP-1, Volt-Ohm-Milliammeter

28 SEP 1989

TECHNICAL MANUAL

OPERATION and SERVICE INSTRUCTIONS with ILLUSTRATED PARTS BREAKDOWN

MULTIMETER

MODEL 260-AFP-1

SIMPSON ELECTRIC COMPANY

F41608-84-D-1384
F41608-87-D-A288

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SECTION VI

PARTS BREAKDOWN

See figures 4-2, 4-3 and 4-4, for the Parts Breakdown of Model 260, Series AFP-1 Volt-Ohm-Milliammeter.

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY
		MODEL 260, SERIES AFP-1 VOLT-OHM-MILLIAMMETER	
4-2	4-000260AFP-1	VOLT-OHM-MILLIAMMETER, Model 260, Series AFP-1	1
	5-112163	. COVER, PROTECTIVE, Meter	1
-1	10-861502	. CASE ASSY	1
		(ATTACHING PARTS)	
	1-137156	. SCREW, MACHINE, Fil hd, Brass, No. 6-32 x 1-1/4 in. lg	4
	1-401857	. WASHER, LOCK, Int. Tooth, No. 6	4
-2	10-860158	. . HANDLE	1
		(ATTACHING PARTS)	
	1-114883	. . STUD, No. 26	2
	852	. . FOOT, RUBBER, With No. 4-40 washer (Mfd by 70485) (55026 P/N 1-117829)	4
		(ATTACHING PARTS)	
	1-115793	. . SCREW, MACHINE, Binder hd, Brass, No. 4-40 x 1/4 in. lg	4
	3-320314	. . CASE	1
-3	950	. BATTERY, Size D, 1.5 Volts (Mfd by 83740) (55026 P/N 1-111798) (B1)	1
-4	417	. BATTERY, 15 volts (Mfd by 83740) (55026 P/N 5-110176) (B2)	1
	10-861503	. PANEL SUBASSY	1
-5	1-115790	. . KNOB, ZERO, Black with white circle	1
	10-861504	. . BOARD SUBASSY, Printed circuit (See figure 4-3 for breakdown)	1
		(ATTACHING PARTS)	
	1-132270	. . SCREW, MACHINE, Binder hd, Brass, No. 6-32 x 5/16 in. lg	2
	1-131539	. . NUT, HEX, Brass, No. 6-32 x 1/4 in.	2
	1-401862	. . WASHER, LOCK, Int. tooth, No. 6	2
-6	Part Deleted		
-7	5-110187	. . FUSE, CERAMIC, 1/4 x 1-1/4 in., 10 amp (F1)	1
	ABC10	. . FUSE, CERAMIC, 10 Amp, FSCM 71400, 5920-00-280-50002	1
-8	67P10404	. . CAPACITOR, FIXED, 0.1 mfd, 400 Vdc (C1) (Mfd by 56289) (55026 P/N 1-113733)	1
-9	1-116491	. . RESISTOR, FIXED, Carbon, 20.2 megohms ± 1%, 2w (R21)	1
-10	1-113353	. . RESISTOR, FIXED, Carbon, 80 megohms ± 1%, 2w (R20)	1
	10-650081	. . SHUNT ASSY, 10 Amp	1
-11	1-132737	. . . NUT, HEX, Brass, No. 8-32 x 1/4 in.	1
	1-401863	. . . WASHER, LOCK, Int. tooth, No. 8	1
	1-131556	. . . WASHER, FLAT, No. 8, 3/8 OD x 1/32 in. thick	1
	1-115837	. . . TAP, MILLIVOLT	1
-12	5-112162	. . . SHUNT, 10 Amp, 250 millivolt dc (R22)	1
-13	5-110179	. . SWITCH, Open-Blade (S3)	1
		(ATTACHING PARTS)	
-14	5-130180	. . SCREW, MACHINE, Rd hd, Brass, No. 2-56 x 1/2 in. lg	2
	1-401859	. . WASHER, LOCK, Int. tooth, No. 2	2
-15	5-110184	. . SCREW, LATCH	1
	10-861202	. . RELAY ASSY	1
		(ATTACHING PARTS)	
	1-131484	. . SCREW, MACHINE, Rd hd, Brass, No. 2-56 x 3/16 in. lg	2
	1-401859	. . WASHER, LOCK, Int. tooth, No. 2	2
-16	G11G	. . . DIODE, SILICON (Mfd by 89397) (55026 P/N 5-110185) (CR3)	1

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY
		MODEL 260, SERIES AFP-1 VOLT-OHM-MILLIAMMETER (CONT)	
-17	5-110182	. . . BRACKET, RELAY	1
		(ATTACHING PARTS)	
-18	1-112618	. . . . SCREW, MACHINE, Rd hd, Brass, No. 5-40 x 1/4 in. lg	1
	1-404424	. . . WASHER, LOCK, Ext. tooth, No. 5	1
		----*----	
-19	SR64003B	. . . RELAY (Mfd by 05432) (55026 P/N 5-110181)	1
		(K1) with relay contacts (S4)	
-20	1-115789	. . KNOB, AC-DC, Black with white pointer	1
-21	3-260180	. . KNOB, RANGE SWITCH	1
		(ATTACHING PARTS)	
	1-114178	. . SETSCREW, Headless cup-point, St1, No. 8-32 x 3/8 in. lg	1
		----*----	

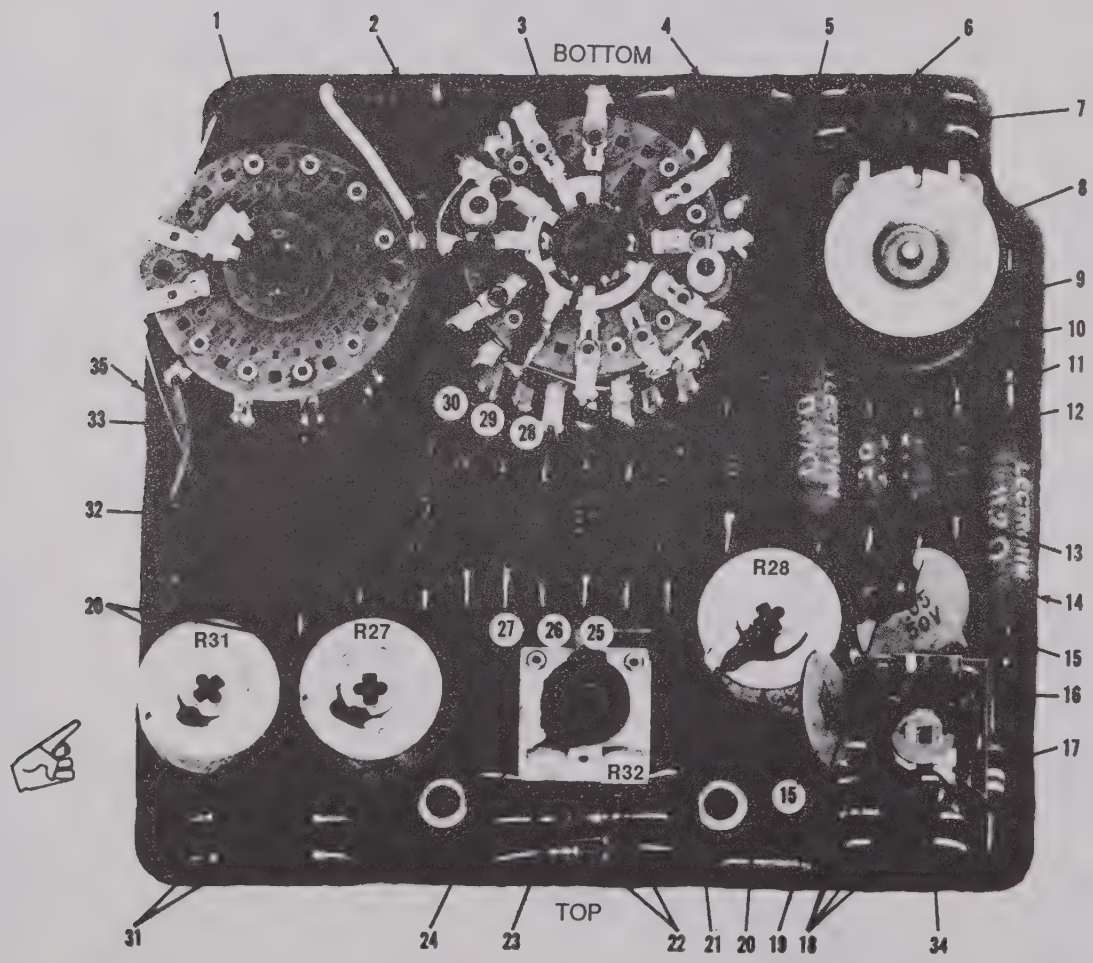

Figure 4-3. Printed Circuit Board Sub-assembly

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY
-22	5-110183	. . PUSHBUTTON, Reset	1
		(ATTACHING PARTS)	
	5-110184	. . SCREW	1
	254-090601		
	01-0101	. . CLIP, CANOE, NYLON (Mfd by 02768) (55026 P/N 5-112338)	1
		----•----	
-23	2-112854	. . RUBBER, FOAM, 5/16 x 3/4 x 1 in.	2
-24	15-307838		
	AFP-1	. . METER, Cover with glass, P/N 00-005674 for 260 series.	1
		AFP1 through 7 meters. P/N 0-005572 for 260 series	
		1 through 5m meters, P/N 10-560212 for 260 6XLP meters	
-25	10-830115	. LEAD ASSY, TEST	1
-26	3-811310	. CONTACT ELECTRICAL	4

FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY
		PRINTED CIRCUIT BOARD SUB-ASSEMBLY	
4-3	10-861504	BOARD SUBASSY, Printed circuit (See figure 4-2 for next higher assy)	Ref
-1	240493K	. SWITCH, ROTARY, 1 section, 3 position (S2) (76854) (55026 P/N 5-110189)	1
-2	1-111030	. RESISTOR, FIXED, Composition, 8.2K ± 5%, 1/2w (R24)	1
-3	243420-2	. SWITCH, ROTARY, 2 section, 12 position (S1) (76854) (55026 P/N 10-861203)	1
-4	5-110156	. RESISTOR, FIXED, Carbon, 113.4K ± 1%, 1/2w (R4)	1
-5	5-110165	. RESISTOR, FIXED, Carbon, 7.5K ± 1%, 1/2w (R26)	1
-6	5-110155	. RESISTOR, FIXED, Carbon, 9905 ohms ± 1%, 1/2w (R3)	1
-7	5-110154	. RESISTOR, FIXED, Carbon, 143 ohms ± 1%, 1/2w (R2)	1
-8	5-110164	. RESISTOR, VARIABLE, 10K ± 30% linear taper (R25)	1
-9	5-110153	. RESISTOR, FIXED, Carbon, 1089 ohms ± 1%, 1/2w (R1)	1
-10	5-110193	. RESISTOR, FIXED, Wirewound, 0.47 ohm ± 1%, 5w (R17)	1
-11	5-110195	. RESISTOR, FIXED, Wirewound, 2 ohms ± 1%, 3w (R19)	1
-12	5-110157	. RESISTOR, FIXED, Carbon, 238 ohms ± 1%, 1w (R5)	1
-13	5-110194	. RESISTOR, FIXED, Wirewound, 22.5 ohms ± 1%, 3w (R18)	1
-14	5-110192	. RESISTOR, FIXED, Wirewound, 11.2 ohms ± 1%, 5w (R16)	1
-15	5-110191	. CAPACITOR, FIXED, Ceramic, low voltage disc, 0.05 mfd +80% −20%, 50 Vdc (C2, C3)	2
-16	10-861636	. SWITCH, ELECTRONIC OVERLOAD SUB-ASSY (See figure 4-4 for breakdown)	1
-17	1-113949	. RESISTOR, FIXED, Composition, 100K ± 10%, 1/2w (R23)	1
-18	5-110185	. DIODE, SILICON (CR4, CR5, CR6, CR7)	4
-19	1-114227	. RESISTOR, FIXED, Composition, 470K ± 10%, 1/2w (R11)	1
-20	1-116254	. RESISTOR, VARIABLE, Wirewound, 5K ± 10% (R27, R28, R31)	3
-21	5-110161	. RESISTOR, FIXED, Carbon, 45K ± 1%, 1/2w (R10)	1
-22	1-115970	. DIODE, GERMANIUM (CR1, CR2)	2
-23	1-110670	. DIODE, SILICON, Protection (CR8)	1
-24	1-110193	. RESISTOR, VARIABLE, 200K ± 20% (R32)	1
-25	5-110158	. RESISTOR, FIXED, Carbon, 37.5 K ± 1%, 1/2W (R6)	1
-26	5-110162	. RESISTOR, FIXED, Carbon, 150K ± 1%, 1/2w (R12)	1
-27	5-110159	. RESISTOR, FIXED, Carbon, 200K ± 1%, 1/2w (R7)	1
-28	5-110160	. RESISTOR, FIXED, Carbon, 800K ± 1%, 1/2w (R8)	1
-29	5-110163	. RESISTOR, FIXED, Carbon, 1 megohm ± 1%, 1/2w (R13)	1
-30	1-113362	. RESISTOR, FIXED, Carbon, 4 megohms ± 1%, 1/2w (R14)	1
-31	5-110166	. RESISTOR, FIXED, Carbon, 5K ± 1%, 1/2w (R29, R30)	2
-32	1-115763	. RESISTOR, FIXED, Carbon, sleeved, 15 megohms ± 1%, 1w (R15)	1
-33	1-115765	. RESISTOR, FIXED, Carbon, sleeved, 3.75 megohms ± 1%, 1w (R9)	1
-34	1-117046	. CAPACITOR, FIXED, Ceramic, 500 pf ± 10% (C4)	1
-35	5-110167	. BOARD, Printed circuit	1

NOTE

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FIG. & INDEX NO.	PART NO.	1 2 3 4 5 6 7	DESCRIPTION	UNITS PER ASSY

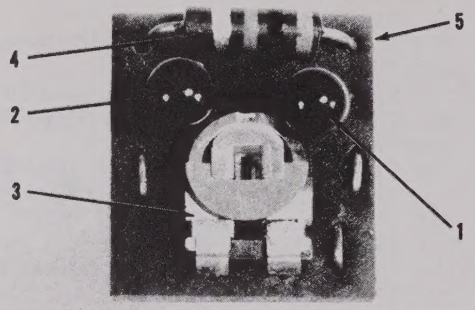
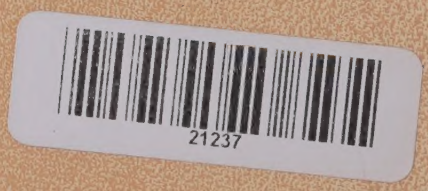


Figure 4-4. Electronic Overload Switch Sub-assembly.

4-4	10-861636	SWITCH SUBASSY, Electronic overload ..... (See figure 4-3-16 for next higher assy).	Ref
-1	5-112522	. TRANSISTOR (80058 Type No. 2N4227) ..... (Q1)	1
-2	5-112523	. TRANSISTOR (80058 Type No. 2N4228) ..... (Q2)	1
-3	5-112521	. RESISTOR, VARIABLE, 47K ± 20%, ... 1/2W (R33)	1
-4	MS35043-13	. RESISTOR, FIXED, Composition, 1K ±10%,. ..... 1/2 W (55026 P/N 1-110644) (R34)	1
-5	5-112520	. BOARD, Printed circuit	1

VENDORS CODE LIST

Code	Manufacturer
02768	Fastex Division of Illinois Tool Works Des Plaines, Illinois
03508	General Electric Company Semi-Conductor Products Dept. Syracuse, New York
05432	Jaidinger Mfg. Company, Inc. Chicago, Illinois
55026	Simpson Electric Company 5200 W. Kinzie Chicago, Illinois
56289	Sprague Electric Company North Adams, Massachusetts
70485	Atlantic India Rubber Works, Inc. Chicago, Illinois
76854	Oak Mfg. Company Crystal Lake, Illinois
80058	Joint Electronics Designation System
83740	Eveready Division of National Carbon Division of Union Carbide Corporation New York, New York
89397	General Instruments Corporation Automatic Mounting Division Chicago, Illinois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